THE EYES OF INDUSTRY

Leonard W. Jones

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Leonard W. Jones, M.D.

PREVENTION OF BLINDNESS SERVICE

COMMISSION FOR THE BLIND
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THE EYES OF INDUSTRY

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There never was a period in the history of American industry when eyes, good eyes, meant so much to the welfare of our nation as they do today. Skilled fingers count. Judgment and reasoning and the other powers associated with a normal brain count, too. Legs count to some extent. So do stout hearts, normal lungs, a well functioning gastro-intestinal tract, and a well-balanced nervous system. But if priority were given to any one organ in industry today, it should be to the organ of vision. It is true that at present places are being found in industry for the totally blind but it is harder to place them satisfactorily than it is to place the maimed and the deaf. For eyes that do not see are a tremendous industrial handicap to their possessor, and to the welfare of the great nation to which we belong.

PHYSICAL FUNCTIONS AND PRE-PLACEMENT EXAMINATIONS

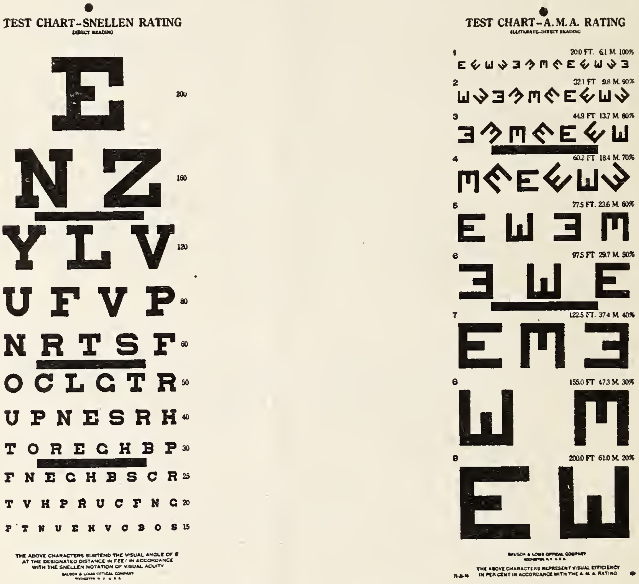
The various jobs in divers industries require visual functions differing somewhat in kind and degree, so that it is advisable, especially in the larger and more diversified industries, that applicants for employment should have their visual functions tested through certain tests which will establish the applicant's visual fitness. When these tests are properly carried out, the applicant can then be allocated to a job for which his eyes are best suited.

It is obvious that an aviator will require vision of a higher type than the man who operates a bulldozer or a steam shovel. It is obvious, also, that a watch repairer or tool maker requires vision of a different type from that of a janitor or that of a woman who dishes out soup in a cafeteria. And the girl who matches shades of buttons in a factory, or hues of silks or rayons in a hosiery mill, will need a sense of color that is entirely unnecessary for a woman who sprays black lacquer on camera casings.

Functions of the eye are chiefly these: Central distance vision, near vision, field of vision, binocular vision, stereoscopic vision and color vision. The other functions of the eye, mostly associated with the female of the species, such as lustre, charm, glamour and the like, do not receive any direct recognition in industry, though indirectly they may have considerable value, especially in the selection of a stenographer, secretary, receptionist, waitress or shop clerk.

TYPES OF EXAMINATIONS

CENTRAL VISION Industry at one time evaluated the function or value of the eyes purely in terms of central vision. The other factors in good vision were known but very little attention was paid to them in judging a new employee's fitness for his job.



TYPES OF VISION TESTING CHARTS

Courtesy, Bausch and Lomb Optical Company

The examiner took the central visual acuity on a test type hung twenty feet away from the applicant. It was recorded as 20/15 (better than normal), 20/20 (normal), 20/30 (a little below par), 20/40 (the minimum allowed for driving an auto or truck in most States), and 20/80, or so-called "industrial blindness." If a man had worse vision than 20/80 he was not considered a safe man to have around a factory and usually lost his job. We used some of these men in war work because our industrial manpower was low.

Now, before we go any further, we ought to get this and get it straight: The term 20/20 (twenty-twenty) is not a fraction. It is merely a short way of saying that a man sees at twenty feet what he ought to see at twenty feet—that he has normal vision. If the term 20/40 (twenty-forty vision) were a fraction, it would mean a fifty percent loss in vision. Yet most States allow a man with "twenty-forty vision" to drive a car, and many a man does skilled work with no better vision. It would be foolish to conclude that a State would allow a man who was half blind to drive a car or that a man could do skilled labor in the same visual predicament. It would be better then, instead of saying "twenty-forty," to say "twenty over forty" and say it understandingly. A man who has "twenty over forty vision" has lost, according to the best authorities, only about twenty percent of his vision.

There is another part to central vision besides distance central vision. It is reading central vision. The usual reading distance for most people is 13 inches to 18 inches from book to eyes, known as "near point vision." While this is, in a way, a measure of vision, it is also a measure of accommodation, or a person's power to put into play his focusing apparatus.

A man's power to focus his eyes for near vision becomes less as he grows older, and at about the age of 45 he has to hold print, blueprint, drawings, and micrometers farther from his eyes in order to see small figures. The oculist smiles politely when the patient says, "I don't need stronger glasses; I need longer arms." To tell the truth, he has heard this witticism so often that he regards its perpetration as just another cross for him to bear.

So, in testing an employees' vision, especially if he be in the older years, we usually test his ability to read fine print and also determine what additional lens must be added to his distance lens so that he can read it. This is usually expressed as "near point of accommodation," "reads Jaeger 1 at 15 inches," "with a plus 1.00 added," or similar notation.

FIELD OF VISION

Field of vision, which is a measurement of the area or field in which a person sees, is a measure of the peripheral vision. It is not as important to the man of industry as his central vision but it has its uses. It enables a truck driver to look straight ahead at the rear end of the car in front of him and yet see, "out of the corner of his eye," the car threatening to cut in on him from the side street. It makes it possible for the steam shoveller to dump his load at the right spot. It aids every employee to avoid running into narrow doorways, projecting posts, and his fellow employees. To the aviator it is almost an absolute essential for his safety.

The field of vision is not always tested or measured in industry unless special cases or needs call for it. It can be done roughly as follows: The applicant faces the examiner. Then the examiner covers his left eye with his hand and the applicant covers his right eye with his hand and fixes the uncovered right eye of the examiner with his uncovered left eye. The examiner then puts his fingers either above, below, to right or left, and asks the applicant how many he holds up. If there is a blind area in any place the applicant will miss the count in the field corresponding to the unseeing area. A finer test than this may be made with a piece of cotton wound on an applicator or toothpick. Still finer tests are made with instruments for field taking known as tangent screens, perimeters or scotometers. A very small area of blindness, less than a millimeter in size, can be successfully mapped out by one of these instruments.

If a man has good central vision, and that is all that is required, he can get along very nicely with only one eye to do highly skilled work, ignoring the vision in the off eye. So does the microscopist in a medical or research laboratory who works with the conventional or one-eyed microscope.

Most jobs, skilled or unskilled, require two-eyed vision. The two eyes working together in perfect unison give the possessor binocular vision and, in its most perfect functioning, 100 percent stereoscopic vision. A pair of eyes has as its nearest optical imitator, two small cameras suitably aimed and focused. Such cameras are usually combined into one camera with two parallel openings and lenses, a stereoscopic camera. It is by means of such a camera that stereoscopic pictures are taken; pictures that are not flat as in an ordinary camera but in which the various objects stand out in apparent relief as our own eyes see them. There is a sense of space between buildings or between branches of trees that is not apparent in the ordinary photograph.

BINOCULAR VISION Good binocular vision is highly essential for certain jobs. A carpenter hammering a nail is likely to miss the nail and hit his fingers if his binocular vision is imperfect. He is not able to judge the distance. A ditch laborer sledging a chisel bar held by a fellow workman may miss the bar and seriously injure his partner if his binocular vision is poor. An aviator with only one useful eye may fly his plane all right but heaven help him when he tries to make a landing. His judgment of distance is so poor that he may crack up. It is true that Wylie Post, the famous one-eyed aviator, flew around the world. His flying experience to some extent made up for his visual handicap. However, the mystery of his crash in the Aleutians may possibly be explained by his failure to possess binocular vision.

In industry, binocular vision is rated chiefly by muscle tests. First we test the power of the eyes to converge. If a man cannot turn in his eyes to at least eight centimeters he is apt to tire readily at prolonged close work. This test is known as the "near point of convergence" or as it is usually abbreviated, "NPC." The next test is the relationship of the image of each eye to that of its fellow when gazing into distance, say 20 feet. There are various ways of breaking up the images of the two eyes but the one usually employed is a device known as a Maddox rod. This is a lens with a corrugated surface. When placed before the eye with the corrugations in a vertical position, it produces a fine line or streak of light as the observer looks at a spotlight. If the corrugations are horizontal, the streak of light becomes vertical. To test the muscles that pull the eyes in or out, the right eye sees the spotlight and the left eye sees the vertical streak. If this streak goes to the left of the light, the eyes show a tendency to turn in which is expressed by the Greek term "esophoria." If it goes to the right of the light, it is "exophoria."

The streak is now placed horizontally. If the observer sees the streak above the light, then there is either a tendency of the right eye to turn up or the left eye to turn down. At any rate the image of the right eye will be on a lower level than that of the left. The amount of deviation can be measured by prisms, and we say that the employee has so many prism diopters of "right hyperphoria," or tendency to turn the right eye up. We could as well say that he has a similar amount of "left hypophoria." * These "phorias" and their effect on the working efficiency of an employee must be taken with considerable judgment on the part of the examiner. Since they are only "phorias," that is, tendencies to turn and not actual turnings, the employee does not see double. He is able to hold the two images as one image. But if this is excessive, say eight exophoria or four diopters of hyperphoria, he is apt not only to have his eyes tire easily, but when tired to relax into double vision with headaches, nervous tension, and all that is associated with eyestrain. Since this control is a muscular effort, it stands to reason that a robust, healthy individual will stand up better against a "phoria" than a sickly, anemic workman. This should be taken into consideration by the examiner.

Persons with poor binocular vision should not be put on any jobs that demand a judgment of distance. Such jobs include punch presses, lathes, steam shovels, hand drills, the testing of range finders, and all tasks involving fine measurements and the like.

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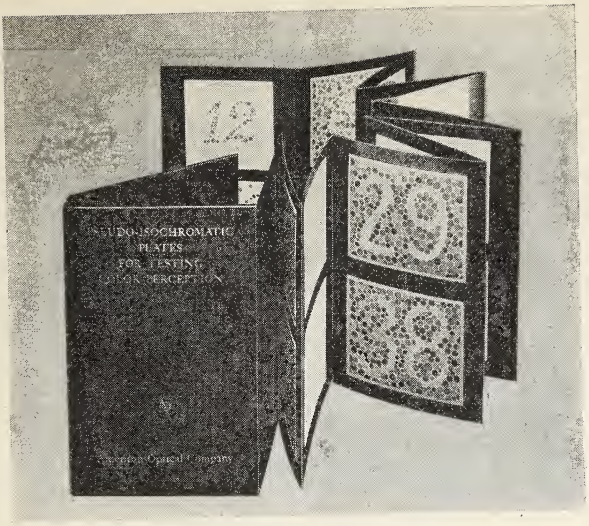
* Tendency to turn the left eye down.

STEREOSCOPIC VISION Stereoscopic vision, which is a sort of glorified or more perfect binocular vision, is usually tested on a common hand stereoscope like those which used to adorn parlor tables before the advent of movies. With this stereoscope go suitable pictures and designs, some of them merely travel scenes and others calculated to test the various "phorias." If an employee does poorly on the "phoria" tests as made by the Maddox rod, he should be tested by the stereoscopic special cards that definitely prove the state of his binocular vision.

COLOR VISION Finally, we come to the test for color vision. In industries where color is not a problem, this test is not made. But in industries where different colored plastics, silks, or rayons are used, it is highly important that an employee should have good color vision. It is also important in certain chemical laboratories and processing plants where tests involve color perception. In button factories where the girls have to sort out shades of colors as the buttons go by on a moving belt, very delicate perception of colors and shades is necessary. In the photographic industry, now that color is coming more and more into use, this well-developed color sense is a necessary qualification for employees who work in color departments.

The simplest way to test color vision is by the Stillings or Ishihara tests, because these can be used without the applicant having any knowledge of the names of colors. He calls out numbers painted in small circles of varying hues against a background of confusing colors. He can read the numbers if his color sense is normal; if it isn't, he cannot. To classify more accurately the type and degree of color vision or color defect that he has, the Holmgren wool test may be made. Here the candidate is given a standard color which bears a letter and he must match this with various small skeins of wool that have numbers attached.

Tests like the above require considerable time, a special place with properly illuminated charts, and an intelligent eye examiner or trained nurse to conduct the examination properly—in other words, the Time, the Place, and the Girl. In order to speed up such an examination and to do mass production in large departments, experts from Purdue University, Bausch and Lomb Company, and the Eastman Kodak Company have recently combined their resources to produce a machine which will do the work. The employee to be tested looks into a sort of glorified stereoscope. This is illuminated by standard lighting in a closed box. By means of a series of pictures calculated to test the various functions of the



COLOR PERCEPTION TEST
Courtesy, American Company

examinee's vision, the investigator can very rapidly check the man's central vision, muscle balance, range of reading vision, binocular, stereoscopic, and color vision. He can, in a few minutes, determine the employee's vision capabilities in percentage terms and his capacity for certain jobs. Surveys have been made of whole departments in various industries by this machine and the results compare very closely with the known capabilities of the workers tested.

The machine, of course, can never replace the examiner because all eye examinations must include a careful examination of the normal and abnormal conditions of the eye. There must be a check of old injuries, corneal scars, lens opacities, and retinal corneal and optic nerve diseases that may be progressive. When this examination is concluded, the examiner has to express his opinion as to whether the pathological lesion will now, or at any time, interfere with the applicant's vision and whether it may get so bad that he might become a charge on the company, legally or morally.

THE EYES AND THE JOB

Now, having given a sort of bird's eye view of the different tests used in industry to determine an applicant's fitness for certain jobs, it might be well to consider the practical application of these tests to the individual employee. Naturally, since there is no standard method agreed upon by all industries, the tests and restrictions and the emphasis put thereon will differ with the examiner, with the factory, and with the nature of the work which the particular factory does. In general, the larger the plant, the better the position it is in to hire skilled examiners, whose standards will be higher. But, here again, a plant whose work is much diversified is in a better position to use employees of all degrees of vision than one whose output is a single, highly specialized product.

We will take you in imagination to a factory, or rather to the eye clinic of a large industrial plant, where the work is very diversified and where competent oculists and nurses especially trained to conduct its eye examinations are employed.

The first man to be examined is a big fellow who has lost one eye in a barroom brawl. He has vision of 20/15 in the other eye with a full field, no eye pathology, and is able to read what is known as Jaeger 1, or the finest Bible print. Obviously, he has no binocular vision, so he should not be put at any job where the judgment of distance is important. Therefore he is not placed on a punch press but is assigned to a construction job on a new building which is being erected.

The next employee is a girl of 18, who presents no problem. Her vision is 20/40 without glasses and 20/20+with glasses. She has full binocular vision. Because she knows shorthand and typewriting, she gets the post she wants, a secretarial position in the export department.

Now comes a young man with thick concave lenses. He is a high myope, or near-sighted individual. Without glasses he has 5/200 vision and with glasses only 20/40 vision, but he can read the finest print and has had an excellent education. In peacetime, he cannot be accepted by this particular industry because there is always the danger of such a man having a detachment of the retina or progressive loss of sight. In such a case, this company makes a practice of paying its employees compensation, even though the company is not at fault. Naturally, the industry tries to have as few such cases as possible. During wartime, however, a place would be found for him as a shipping clerk.

Now comes an able-bodied, alert, young man with 20/20 vision without glasses, no symptoms, full binocular vision, ocularly perfect. He has been a punch press operator in another plant and he gets a similar job here.

Next is a man with 20/20 vision in one eye, but the other, though healthy, has never developed better than 20/100 vision. He has no binocular vision, yet he wants a job on a turret lathe. He is not given this work but is allotted a place in the sheet metal department where the work is not too fine and judgment of distance is not essential.

Our next candidate is a girl of 20. She has fine vision and is needed in a department that has to pass on color photographic prints. She has full color vision, as tested on the Ishihara charts, and so she is sent to that department.

The following job-seeker is a man with 20/20 vision in one eye and 20/40 in the other, an alternating squint and, of course, no binocular vision. He is sent to an inspection job where his one-eyed vision is adequate.

The next prospective employee is a young chemist, the product of one of our highest technical schools. He has good vision and is badly needed in a department that deals with color photography. Unfortunately, the Ishihara test shows him to be red-green color blind. In spite of this handicap, he can be used in a research laboratory where color vision is not particularly necessary. If he ever has to make a color test, he will be obliged to ask another chemist or a girl secretary to take the reading.

And so it goes. Employees who make silk stockings require certain visual functions. The man who operates a steam shovel does not need accurate central vision; "twenty over forty," or even less, may do, but he does require good binocular vision or he may dump his load on the wrong spot. The color blind girl will never do as a buyer in the dress goods department of a store, but she may achieve much as secretary to an executive. Aviators who fly the big planes across the continent must have practically everything in vision and must have it without glasses.

The modern goal in industrial medicine, from the viewpoint of the eye examiners, is to find a place in industry for any man willing to work, irrespective of his vision, even to total blindness. It aims to place each and every man in a position where, if he has a visual defect, it will not be too great a handicap for the man himself. It will not endanger his fellow employees, nor will it hamper his employer, who must produce goods in quantity and at cost to meet the competition of other manufacturers.

LIGHTING

There is a good deal of truth and a good deal of bunk written and spoken about the conservation of vision. Manufacturers of light bulbs, lighting equipment, and spectacle lenses and glasses, people who sell glasses, and those who dispense all kinds of colored lenses for cutting down glare, urge the public to buy their wares to conserve their vision. The same magazine that carries an advertisement to increase the illumination by putting in more 60-watt "Razzle Dazzle" light bulbs to save your eyes, will also carry an advertisement urging the public to wear "Remova Glare" lenses and so conserve vision. One says the public is not getting enough light and the other says it is getting too much light.

One lighting expert says that the tendency to myopia among the students in a certain government college is due to antiquated lighting methods with inadequate illumination. He proves this statement by some amazing figures. He ignores the fact that, in another college where the lighting is thoroughly modern and has been approved by lighting experts, the increase in myopia parallels very closely that of the poorly illuminated, antiquated building which houses the government students. But, this lighting expert is in the employ of a lighting company.

Our immediate ancestors, who read by candlelight, kerosene lamps and gaslight, apparently retained their vision just as long as we do today, with all of our brilliant electric lighting. But then, perhaps, they didn't push their eyes so hard. The baneful effect of inadequate lighting and of glare upon the useful life of the human eye is a very difficult thing to prove, one way or the other.

Fortunately, God made the human eye so that it can take a good deal of abuse. The efficiency of the eyes may suffer as a result of inadequate illumination but it would be difficult to prove that any real harm resulted. The best example of damage to the eyes by poor illumination is the oscillating eye, a condition known as nystagmus, which occurs in coal miners after years of employment. But here, position in their work, as well as poor illumination, is a factor.

Efficient lighting for factories, schools, stores, offices and homes can be well worked out by light meters. These consist of an electric cell actuated by a light beam which causes a needle to move along a calibrated dial.

According to Luckiesh and Moss, who have done much research on lighting needs, workers in various occupations require foot-candles of illumination as follows:

100 foot candles or more—fine needlework, fine engraving, fine assembly, and sewing on dark goods.

50 to 100 foot candles—proofreading, drafting, watch repairing, fine machine work, average sewing and needlework.

20 to 50 foot candles—clerical work, ordinary reading, bench work, average needlework on light goods.

10 to 20 foot candles—ordinary office, factory, reading, sewing work.

EYE PROTECTION

The Army has a slogan in regard to its equipment. It goes something like this: "The Army has given you the best, now take the best care of it." We might paraphrase that by saying, "The good Lord has given you the best of eyes, take the best care of them." Adding, "You have only two eyes and there are no spare parts." There is the old story about the municipality that was too penny pinching to build a guard fence past a dangerous precipice. After several serious accidents, the citizens of the town pitched in willingly to pay for an ambulance down in the valley to receive the injured. We could go on from there and revive the old adage about the ounce of prevention and the pound of cure, for the most effective method of taking care of accidents to the eyes is to prevent their happening.

The best way to prevent accidents to the eyes is to wear glasses. A fact well known to industrial eye physicians is that it is a rarity to have an employee injured by broken glass from his spectacles. The missle that breaks the glasses usually expends most of its force on the lenses or frames and the eyes receive little or none of it. It is also true that an object that hits the glasses gets such a sharp reflex act from the eyelids that, when it goes through the glass, it hits a closed eye instead of an open one and the sight is saved.

Employees who work at jobs that are dangerous should be provided with safety glasses. These come in various compositions and shapes. One type consists of a thick glass especially heat-treated so that it is very tough and not liable to break except on severe provocation. The second type is a sandwich glass, like the glass in your windshield. It consists of a layer of glass, a layer of cellophane or similar material, and then another layer of glass. All three layers are so tightly compressed that they form a solid unit and there is no division that one can see. If a piece of steel hits the front piece of glass, it may shatter it. But the broken fragments cling to the middle layer of cellophane to form a cobweb pattern and the broken glass does not fly off. It shatters but doesn't scatter. These glasses can be made up with or without color, in plain glass or with the wearer's prescription incorporated. The objection to them on the part of the sweating workman is that they are hot in summer, that in oily jobs they become coated with a smeary film which cuts down visibility, and that they have to be cleaned frequently.

However, when a workman comes into the eye clinic with a pair of goggles to be replaced that he has worn over an emery wheel, and you see the front face of the goggles frosted from being hit with thousands of small particles of emery or steel, you realize how much that workman owes to his goggles for the saving of his sight.

SAFETY GLASSES AND GOGGLES

Courtesy, Arma Corporation

A young chemist in a research laboratory had been ordered to wear his goggles constantly but one day he disdained to put them on. He was mixing two fluids in glass flasks. The two flasks exploded and blew the glass into his unprotected eyes. One of his eyes had to be taken out and the other lost 50 percent of its vision. He wears goggles now to protect the only eye and the remaining sight that he has. He might have two good eyes today, if he hadn't disdained necessary protection.

A young workman in a defense plant wanted to break off a steel edging. He hit it with a hammer. The steel flew up and a small bit, one eighth of an inch long, pierced the cornea, went through the iris, and landed back in the retina near the optic nerve. A giant magnet readily removed it but this was followed by a hemorrhage into the eye and six weeks later the eye had to be removed. Goggles could have saved the eye.

Next to goggles and glasses in the protection of the eyes, should come care in the prevention of all kinds of accidents. For instance, one man stepped on a broom whose brush was at right angles to the handle. The handle came up and hit him in the eye. The eyeball was ruptured and the eye lost. A young man in a technical school bought himself a hammer of good quality steel. He knew that cheap steel was likely to turn over at the edges and break off, and might hit his eye. The fellow at the next bench bought a hammer of poor quality to save expense. The chip of steel flew off in due time but it struck the eye of the provident mechanic who had bought the good hammer!

Chemists and technicians should be cautioned in the handling of mixtures which may be explosive. Projecting rods and beams should be marked in some way so that they become as conspicuous as a bandaged thumb. Caution should be exercised in using tools that may skid, jars that may fall, chemicals that may spurt. The causes of damage to eyes can be legion. We can not possibly foresee everything that might happen, but we can prevent a good many accidents.

TREATING AN INJURY

There are various ways of handling eye injuries. Small plants usually send their eye cases to an eye physician. Factories that are large enough to employ trained nurses or factory physicians, or the very large plants that have a staff of physicians and surgeons among them one or more ophthalmologists, send the eye case to their own medical department first. The future disposition of the case is decided there, whether it can be satisfactorily treated at the plant or whether it should be referred to a hospital. In one large industrial center, a clinic that handles an immense number of eye examinations has an arrangement with many nearby industrial plants by which they send all of their eye injuries to the center's clinic. In this way the manufacturers are saved the expense of separate eye departments and the clinic is assured of a sufficient, steady practice so that it can maintain all modern means of handling unusual eye injuries. For instance, some of the advantages offered are: The extraction of a piece of steel from the eye by a giant electric magnet, the localization of a piece of steel in the globe by a special X-ray technique, and the immediate seeing and examining of the injured man by a skilled and experienced oculist instead of a general practitioner.

FIRST AID EQUIPMENT The equipment of a first aid station in every plant, regardless of size, should contain the personnel and articles listed below as the minimum requirements for the care of eye injuries:

1. A registered nurse who knows her business, and with sufficient judgment to know when to handle the case herself and when to get needed assistance from a physician.

2. Adequate illumination. This may be a hammer lamp or similar contrivance that can focus a beam of light in a small area. Even better than this good but expensive light is a small pocket flashlight of fountain pen size. With this, a binocular loupe, and an assistant to hold the light, the operator, either surgeon or nurse, is well equipped to see the very small particles of emery or steel on the cornea.

3. A plus 13.00 diopter lens from a trial case. This may be used either as a condensing lens to focus the light beam or as a magnifier to view the foreign body or abrasion.

4. A bottle of 2 percent Fluorescein with sodium carbonate. This solution has the ability to stain green any corneal abrasion, no matter how small, leaving the rest of the cornea clear.

5. An eye doucher or sprayer of the perfume atomizer type that can be held in one hand and sprayed while the other hand holds the eyelids apart.

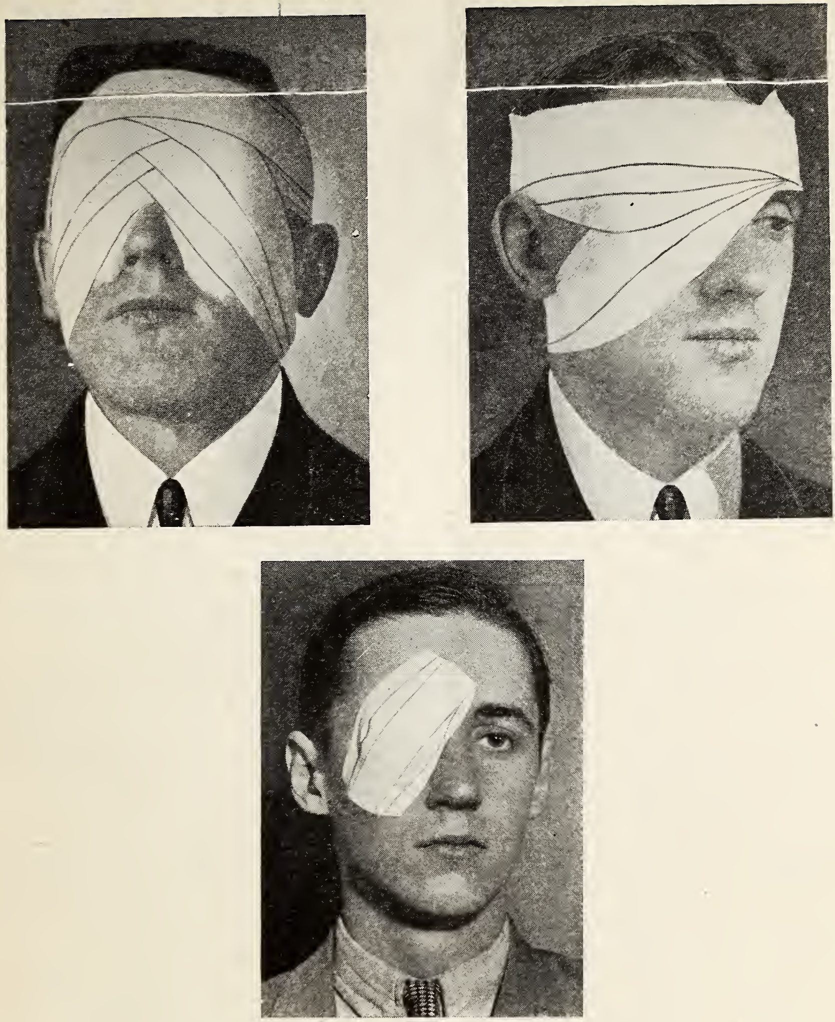
6. Two or more eye spuds of different shapes. Absorbent cotton wound on toothpicks sometimes successfully extracts small foreign bodies from the lids, globe or cornea if they are not imbedded. A piece of horsehair (provided you can find a horse!) looped around the end of a stick or glass rod and fastened there with adhesive plaster or scotch tape, is a useful tool to remove a corneal foreign body, if again, it is not too firmly imbedded.

7. Absorbent cotton, Knapp's eye dressings, adhesive plaster cut in strips about six inches long and one-third of an inch wide and laid down ready for use on the film side of an old X-ray film, and small squares of gauze, make useful dressings to have ready.

8. A small enamel or stainless steel kidney-shaped pus basin.

9. Irrigating fluids, such as saline solution, boric acid or bichloride of mercury (1:5000).

10. Certain fluid medications.



EYE DRESSINGS
Courtesy, Dr. Charles A. Perera

Anaesthetics:
Pontocaine ½ of 1 percent
Butyn 2 percent
Cocaine 4 percent

Of these, the most efficient is cocaine, but it has the disadvantages of softening the cornea and dilating the pupil. For these reasons, pontocaine and butyn are more used today. Occasionally one finds a hypersensitive man for whom cocaine is the only anaesthetic that anesthetizes the eye. It is well, too, to have more than one anaesthetic, for the man who is allergic to butyn is not allergic to pontocaine and vice versa. One can get some fiendish reactions in the eye which is allergic to one or more of the above very useful eye medications.

Dilators:
- Ephedrine 3 percent
- Adrenalin 1:1000

Cycloplegics (pupil dilators and paralyzers):
- Atropine 1 percent
- Homatropine 1 and 2 percent

Miotics (pupil contractors):
- Eserine ¼ of 1 percent
- Pilocarpine 2 percent

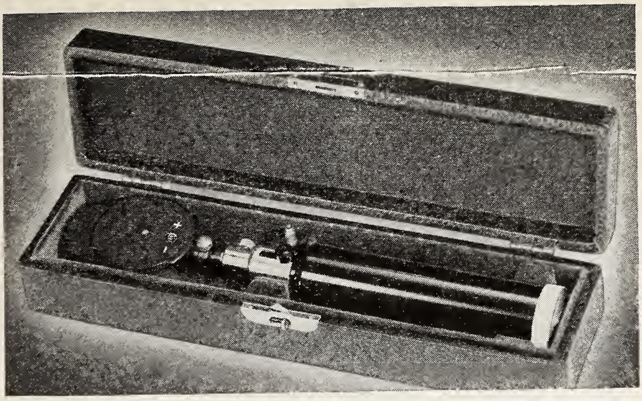
Antiseptics:
- Mercurochrome 2 percent
- Argyrol 20 percent
- Boric and Zinc
- Silver Nitrate ½ of 1 percent
- Silver Nitrate 1 percent

Ointments:
- Boric Acid
- Vaseline
- Atropine 1 percent
- Bichloride 1:5000
- Holocaine and Epinephrin
- Holocaine and Bichloride
- Butesyn Picrate
- Eserine Ointment
- Vitamin A and D Ointment

To these lists can be added other medications as the whim or scientific knowledge of the eye surgeon may direct.

INSTRUMENTS REQUIRED Three instruments should be included in the equipment of every industrial eye clinic. The first is that indispensable optical device, the ophthalmoscope. Without it an eye specialist could not practice his specialty. This instrument may be used to examine both the exterior and interior of the eye. With its cap off, it makes a small diagnostic lamp to use in hunting for small foreign particles on the cornea or tiny abrasions of the corneal surface. It is also the supreme court in deciding how much damage has been done by an injury to the internal structures of the eye.

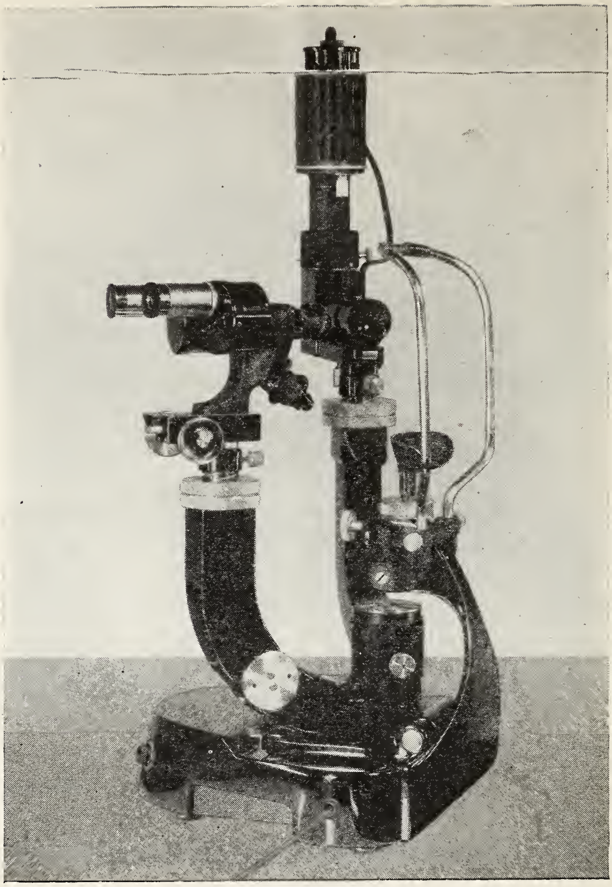
The second instrument is the Snell electrically illuminated eye spud. This little instrument has a chuck by which several small eye spuds are tightly held. The tip of each spud is illuminated by a two-volt electric light with a condensing lens, and the handle is connected by an insulated silk or rubber covered wire to a rheostat controlling the amount of light sent out by the bulb. When an



OPHTHALMOSCOPE
Courtesy, Bausch and Lomb Optical Company

assistant is not available this outfit is invaluable for removing foreign particles from the cornea. Without the spud, it, too, is a fine diagnostic lamp.

The third instrument is a Slit Lamp or Corneal Microscope. This instrument has added a great deal to the armanentarium of the industrial eye surgeon as it has to the non-industrial eye physician. With it one can see tiny particles which have eluded the naked eye or the condensing lens. One can find minute abrasions and erosions of the epithelium. The patient may complain of considerable pain, and examinations by ordinary means may fail to show the cause, with the unjust suspicion that he is making much ado about nothing. The Slit Lamp usually shows the reason for the discomfort.



SLIT LAMP

Courtesy, Bausch and Lomb Optical Company

COMMON INJURIES IN AN INDUSTRIAL PLANT

The common injuries that happen in an industrial plant are as follows:

1. Foreign bodies in the eye. These may vary all the way from dust to a piece of steel in the globe. The first aid nurse should be instructed to put a drop or two of local anaesthetic into the eye, wait five to ten minutes, and then attempt to take the particle out with a flake of cotton, or lightly brush it with a piece of cotton carefully wound on a toothpick. If it doesn't come easily by these simple means, send the patient to the eye surgeon. If it is loose in

the conjunctiva of the lids, gentle flushing with the eye douche may release it. In any event, always turn the upper lids to be sure that no foreign body is concealed behind them.

2. Abrasions of the cornea. Large ones are self-revealing. But abrasions may be so small that they are difficult to find. First anaesthetize the eye, then put in a drop or two of the Fluorescein solution, and wash out with the irrigator. This red-yellow solution turns an abrasion green thus showing it in sharp contrast to the uninjured cornea. Fluorescein has been a great help to the industrial eye surgeon. When the abrasion is found and no foreign body is present, put in a soothing eye ointment and place a patch or dressing on the eye. If the abrasion is serious, send the injured one to an eye doctor. Atropine may be required.

3. Chemical burns of the eye. Theoretically one should neutralize an acid burn with a weak solution of sodium bicarbonate, and an alkali burn with weak vinegar. Don't waste time hunting for these articles, for the very best treatment is to use clean water; a bucketful from the nearest tap will do. If water is safe enough for drinking, it is safe enough to put into the eye. Don't waste time with the hand atomizer. Get the man to put his head into the bucket and open his eyes under the water, or do the same in a basin of cold water, or have him lie down on a bed or operating chair and flush his eye out generously, using large pads of absorbent cotton or clean linen as sponges. Do this, and do it often. If there is much pain, atropine is indicated, and at any rate, some soothing ointment. The best, perhaps, for burns of any kind is butesyn picrate, but holocaine, vitamin A, or boric acid ointments, will do.

As chemical burns are fraught with danger to the vision, a burned employee should be sent to the nearest eye doctor as soon as first aid has been administered. Damage to vision may come from two sources. First, the replacement of clear cornea by more or less opaque scar tissue and, secondly, adhesions of the lid conjunctiva to the conjunctiva of the globe.

4. Contusions of the globe by large objects. These do not happen so very often because anything greater than two inches in diameter usually expends its force against the nose, the eyebrow, or the prominence of the lower orbit. The eye is wonderfully guarded against blows of this character. Usually eyes hit by large objects look worse than they are, while eyes directly hit by a penetrating piece of steel, and in a dangerous condition, look very innocent.

A blow on the eye by a large object generally causes tremendous swelling of the lids, hemorrhage under the skin and under the conjunctiva, and, as time passes, the color changes to what is known as a "black eye." Fortunately, the chief trouble that such eyes occasion is that they provoke embarrassing questions from the victim's business and social associates.

However, every now and then the large object, or a corner of it, gets through nature's defenses and lodges a direct hit. When it does, anything can happen. There may be a ruptured globe, hemorrhage into the anterior chamber, dislocation, or even hernia of the lens, prolapse of the iris, prolapse of the vitreous, rupture of the choroid and retina, or detachment of the retina.

First aid to an injured eye of this character would mean simple cleansing of it with any weak antiseptic solution, from boracic acid to bichloride of mercury, or even plain water, the application of ice or ice compresses, a dressing and bandage, and a reference to the proper eye surgeon.

5. Penetrating wounds of the globe. These are the most dangerous of eye injuries. The particle of steel may be so small that its entry point may be difficult to find. The pain and discomfort is often so small that the employee keeps on working until he notices that something has happened to his sight. A tinsmith was hit by a small clipping of zinc at three o'clock one day. He kept on working until five when the traumatic cataract, which the particle had caused, began to blur his vision.

If there is a collapsed or shallow anterior chamber, an irregular pupil, marked blurring of vision, or a dull look to the pupil, suspect an intra-ocular foreign body, no matter how little discomfort the employee has, and send him to the eye doctor.

With the localization of a foreign body by the X-ray technique of Sweet, and, when magnetizable, the removal by the giant electric magnet, many eyes are saved and useful vision is left to the injured one. But there are still cases that go on to enucleation, or removal of the eyeball. Foreign bodies that are non-magnetizable have to be extracted by other means. The plan usually is to get an exact localization by the Sweet method. Then the eye surgeon goes into the globe by the nearest route and extracts the intruder, either by feel or by the guide of the ophthalmoscope. Glass foreign bodies are not magnetizable and they do not cast a very good shadow by the X-rays. They present a very difficult problem.

Fortunately, the eye injuries of most industrial plants are the removal of minute particles of steel and emery, slight cuts in the conjunctiva or lids, irritating small abrasions and such small fry. They can keep the eye clinic of a big plant very busy. Every now and then something turns up that makes one appreciate the importance of cleanliness and care in handling these injuries, and how much damage a little particle of steel can do.

COMPENSATION FOR EYE INJURIES

No employer would be so hard-hearted as to wish to see injuries among his employees. But in the endeavor to get out his product as rapidly as possible, to cut the cost of production so that he can meet the competition of other manufacturers, he may give insufficient thought to the installation of safety devices and the protection of the workmen against the normal hazards of his occupation. One of those hazards may be the workman's own carelessness.

The Workmen's Compensation Law was passed in New York State, in 1913, to remedy this situation and also to insure employees against the dangers of their jobs.

As this humane law works out, if an employer has many eye injuries among his employees, especially if those injuries have resulted in serious loss of vision, the premium he has to pay his insurance carrier is proportionately heavier. Consequently, he is likely not only to cooperate in safety measures to prevent accidents but to initiate such measures himself. He has found that it is cheaper to prevent accidents than to pay the cost of damages after they have happened.

Now let us see how this law protects the workman. Suppose you are working at home repairing a door. You hit a nail with a hammer and the nail skids and hits your eye. The only compensation you can receive for any time lost or damage done to your eye will depend on whatever accident insurance you carry yourself. If the same accident happens while you are working as the employee of another man, the company employing you is compelled by law to compensate you for the care of your injured eye, for your lost time, and for any permanent loss of vision that you receive.

There are two ways of carrying this insurance, either through the State Insurance Fund or through private insurance companies. These companies and the State Insurance Fund are usually spoken of as "the insurance carrier" or simply "the carrier."

Supposing again that you, as an employee, received this injury with the nail. You would report it immediately to your boss or foreman. He would send you to the company's own first aid hospital or to an outside surgeon or ophthalmologist.

From then until the eye is completely healed, all expenses in connection with your injury would be paid by the insurance carrier. This includes dressings, drugs, X-rays, hospital care, even your glasses if they have been broken or if your accident caused a correctible change in vision.

If your injured eye gets along all right and you recover with no loss of vision—well, that's fine. But supposing you don't. You would then make a claim for this loss before a compensation board which conducts a "hearing" in a kind of court, where you represent the plaintiff and your employer, through his insurance carrier, represents the defendant. You may plead your own case or have a lawyer to represent you.

The law allows you one year after the accident to make the claim and you should know pretty well by then how much loss of vision you have suffered. Under certain conditions the compensation board may even extend the time to two years. But you should serve your employer with a written notice of your accident within 30 days.

If your eye injury prevents you from working at your job, you are allowed two thirds of your average working weekly wage until such time as you are able to resume work, even if this takes the rest of your life.

It would require too much space to cover all the provisions of the law in this pamphlet. But one can briefly state how the awards are made.

1. There is no compensation allowed for the first week of disability unless the disability lasts more than 35 days. In the latter case, the compensation begins from the day of disability.

2. If the loss of vision is correctible by glasses, the injured man cannot claim any more loss than that percent which the glasses fail to correct.

3. If a man already had a loss of 50 percent before an accident and then lost 30 percent more, he could not claim full loss for that eye.

4. If a man loses an eye, even if the vision was defective in that eye prior to the accident, it is regarded as full loss of the eye and he is awarded compensation accordingly.

5. A man who has had a cataract removed, even though he gets 20/20 vision with his glasses, is entitled to the rating of total loss of an eye.

6. The award for the loss of an eye is two thirds of the average weekly wage at the time of injury, for 160 weeks.

7. In addition to these awards, there may be an additional award for "facial disfigurement." A glass eye is considered facial disfigurement.

While the employee has the right to select his own physician or oculist for the care of his injured eye, he usually goes to the specialist selected by the employer. This is a wise move on his part. Employers and insurance carriers have learned through bitter experience that there is no saving in employing other than competent eye physicians for the care of injured employees. Consequently, the workman with a damaged eye usually falls into the skillful hands of one of the best eye specialists in his community. The Workmen's Compensation Law works out very well. The workman no longer has a piece of emery scraped out of his eye by a fellow workman with a sharp and dirty pocketknife with which he has cut his tobacco and manicured his nails.

Naturally there will always be some chisellers. There is the boss who fights the bona fide claim that the injury occurred at his plant. There is the workman who see a good chance to have the eye injury he received at his own home paid for by the insurance company, and states boldly that he was passing along Aisle C in Plant B when he felt something sharp hit his eye. The hearing in the compensation court usually determines the truth.

The eyes of industry today owe a great deal to the scientific examination of their vision, to the proper placing of workmen in tasks suited to their visual capacities, to the better illumination of factories and the protection against glare, to the wearing of safety goggles and the installation of various devices that protect the eyes from flying particles. And if and when those eyes are injured, the workman knows that his injury will be properly cared for and that he will be legally compensated should those valuable eyes receive a permanent loss of sight. The eyes of industry are immeasurably better cared for than the eyes of industry of a generation ago.

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For those who wish to read further on the interesting subject of the eyes of industry there are three excellent textbooks available.

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RESNICK, LOUIS. *Eye Hazards in Industry.*
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Copies of the Workmen's Compensation Law of the State of New York can be secured by writing to the *Chairman of the Workman's Compensation Board, Mary H. Donlon,* 80 *Centre Street, New York, N. Y.*

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